FIG.1

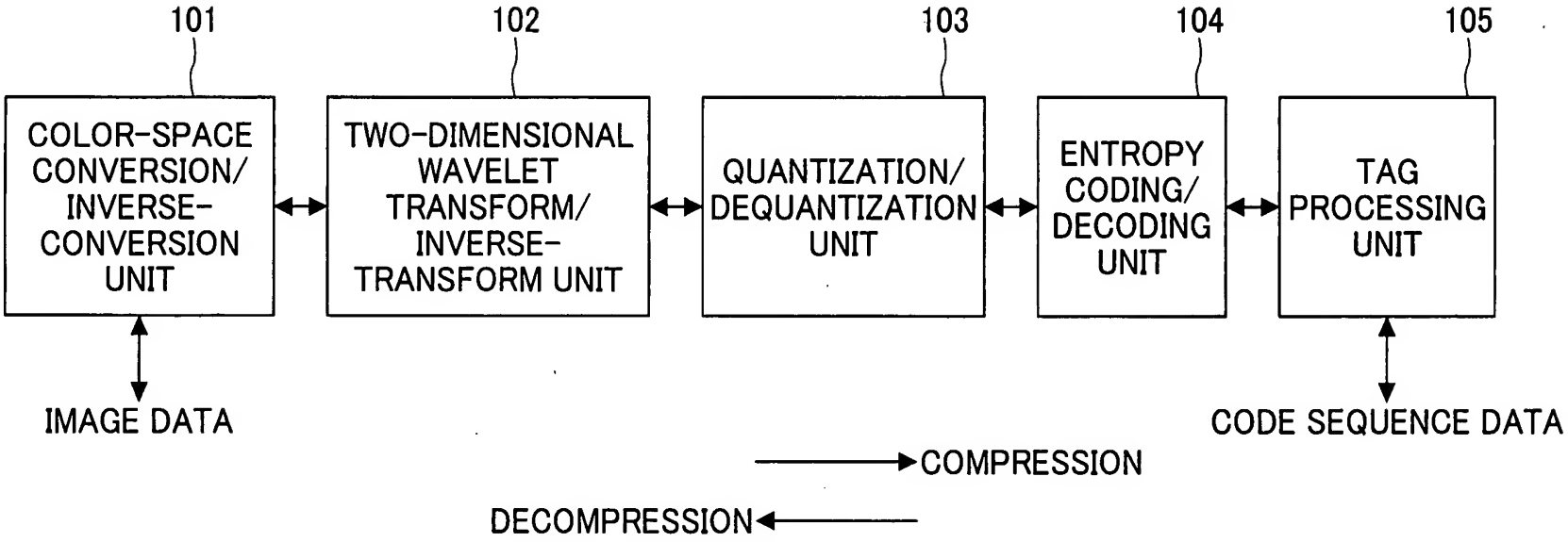

101
102
103
104
105
COLOR-SPACE CONVERSION/ INVERSE-CONVERSION UNIT
TWO-DIMENSIONAL WAVELET TRANSFORM/ INVERSE-TRANSFORM UNIT
QUANTIZATION/ DEQUANTIZATION UNIT
ENTROPY CODING/ DECODING UNIT
TAG PROCESSING UNIT
IMAGE DATA
CODE SEQUENCE DATA
COMPRESSION
DECOMPRESSION

FIG.2

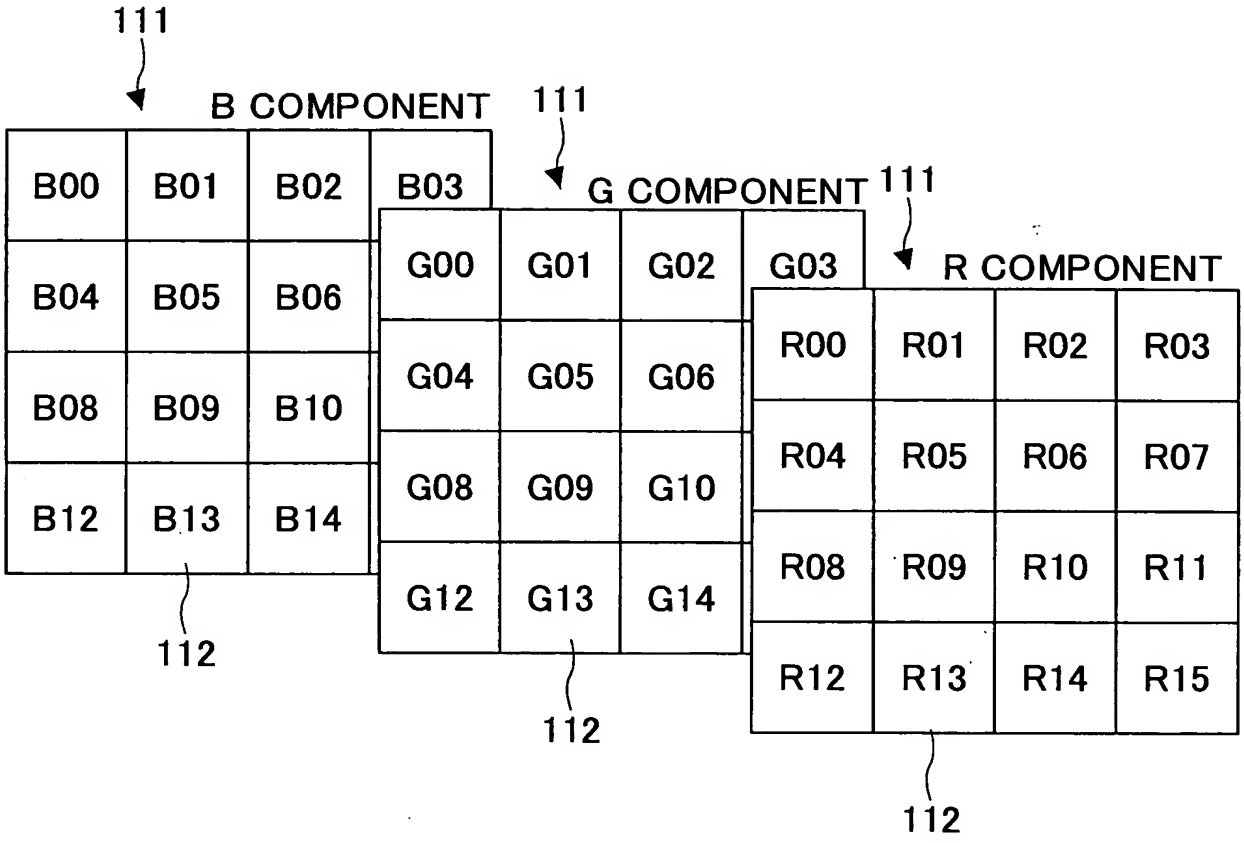
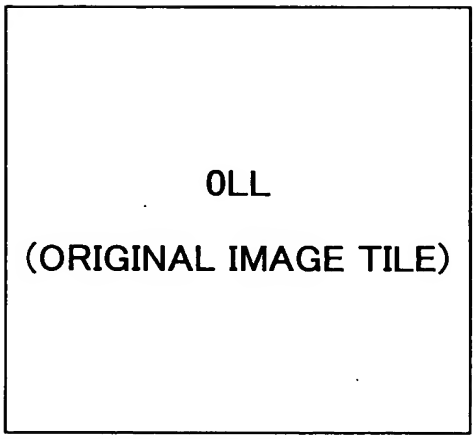
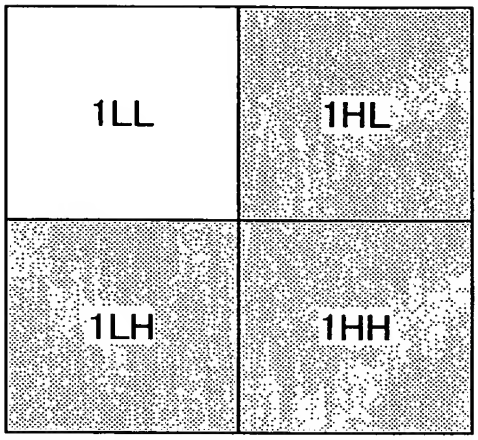

111
B COMPONENT
111
G COMPONENT
111
R COMPONENT
B00
B01
B02
B03
B04
B05
B06
B08
B09
B10
B12
B13
B14
G00
G01
G02
G03
G04
G05
G06
G08
G09
G10
G12
G13
G14
R00
R01
R02
R03
R04
R05
R06
R07
R08
R09
R10
R11
R12
R13
R14
R15
112
112
112

FIG.3A



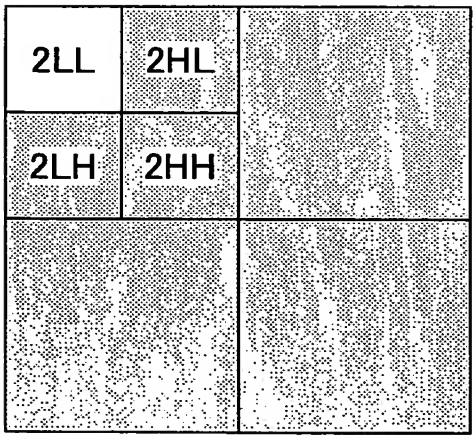
DECOMPOSITION_LEVEL_0

FIG.3B



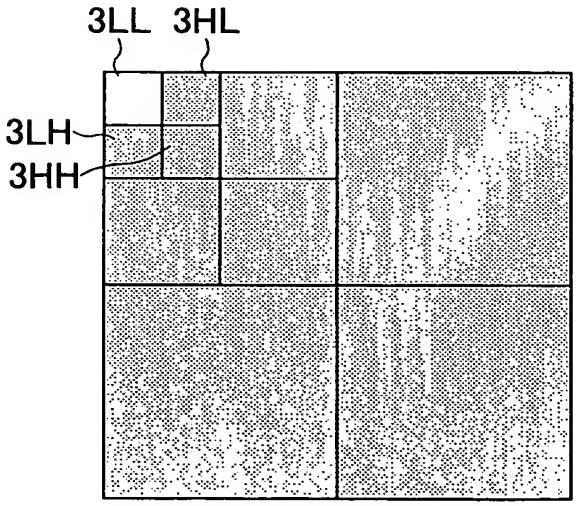
DECOMPOSITION_LEVEL_1

FIG.3C



DECOMPOSITION_LEVEL_2

FIG.3D



DECOMPOSITION_LEVEL_3

FIG.4

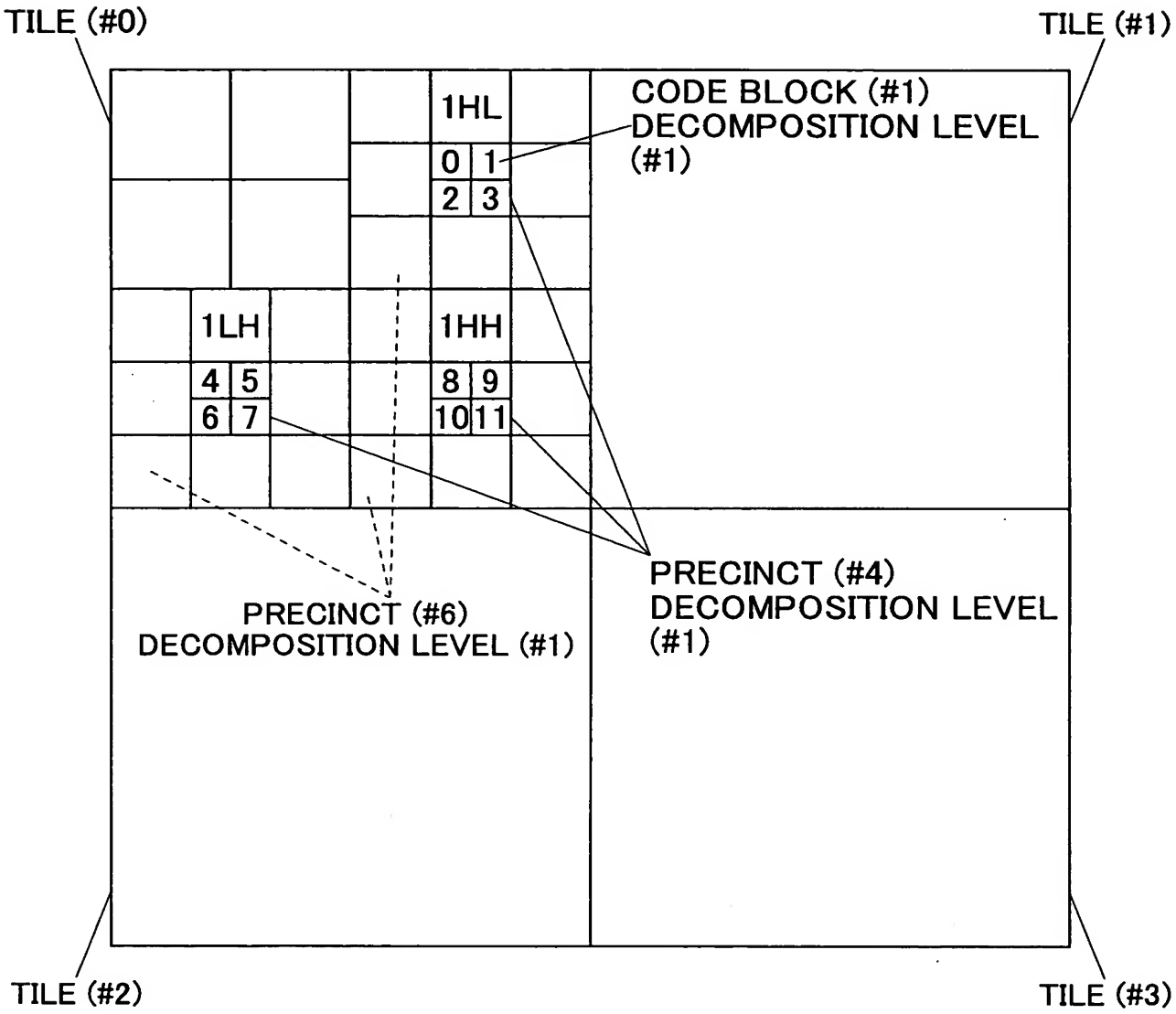

TILE (#0)
TILE (#1)
1HL
0 1
2 3
CODE BLOCK (#1)
DECOMPOSITION LEVEL
(#1)
1LH
4 5
6 7
1HH
8 9
10 11
PRECINCT (#4)
DECOMPOSITION LEVEL
(#1)
PRECINCT (#6)
DECOMPOSITION LEVEL (#1)
TILE (#2)
TILE (#3)

FIG.5A

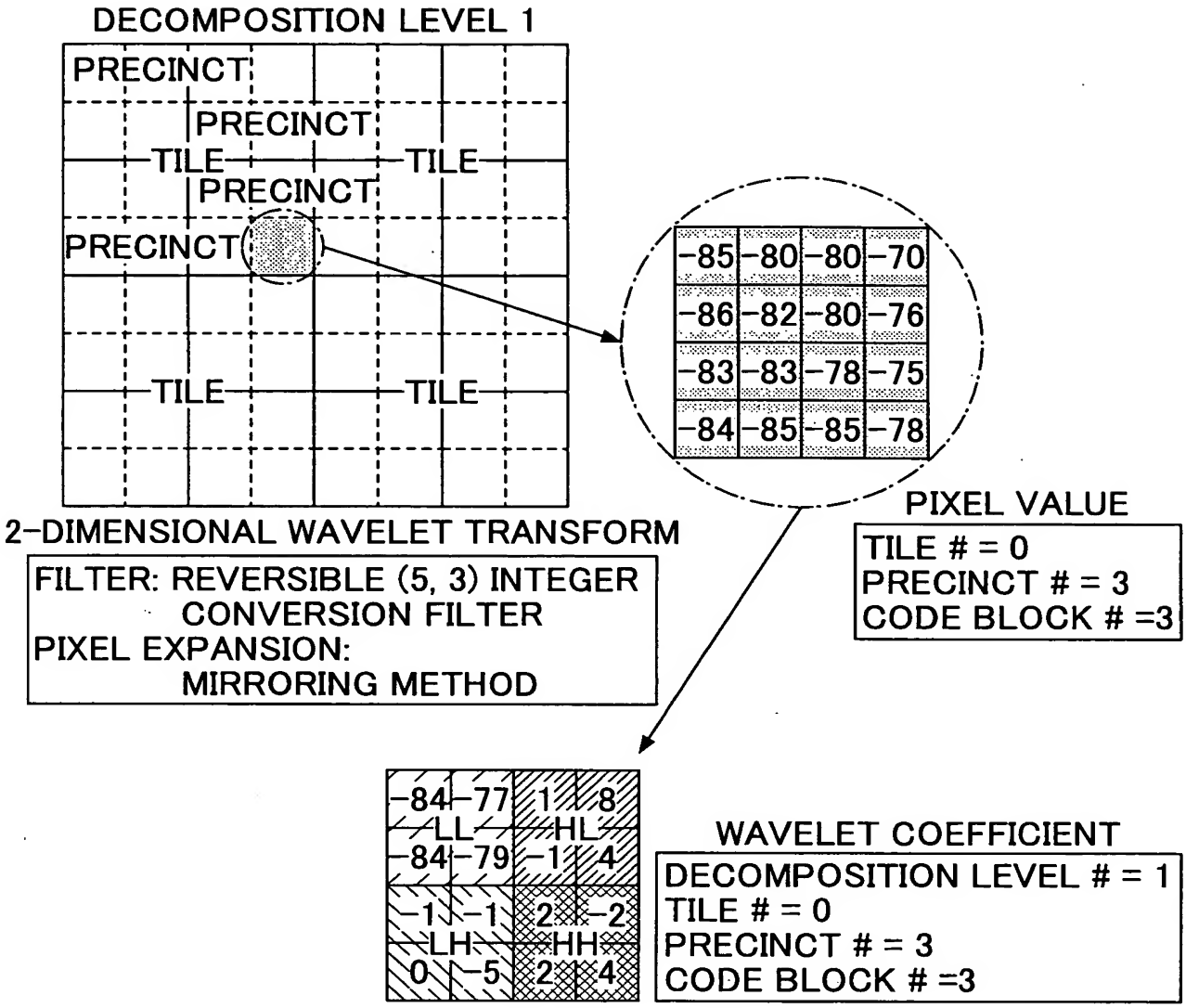

DECOMPOSITION LEVEL 1
PRECINCT
PRECINCT
TILE
TILE
PRECINCT
PRECINCT
TILE
TILE
-85 -80 -80 -70
-86 -82 -80 -76
-83 -83 -78 -75
-84 -85 -85 -78
PIXEL VALUE
TILE # = 0
PRECINCT # = 3
CODE BLOCK # =3
2-DIMENSIONAL WAVELET TRANSFORM
FILTER: REVERSIBLE (5, 3) INTEGER CONVERSION FILTER
PIXEL EXPANSION: MIRRORING METHOD
-84 -77 1 8
LL HL
-84 -79 -1 4
-1 -1 2 -2
LH HH
0 -5 2 4
WAVELET COEFFICIENT
DECOMPOSITION LEVEL # = 1
TILE # = 0
PRECINCT # = 3
CODE BLOCK # =3

FIG.5B

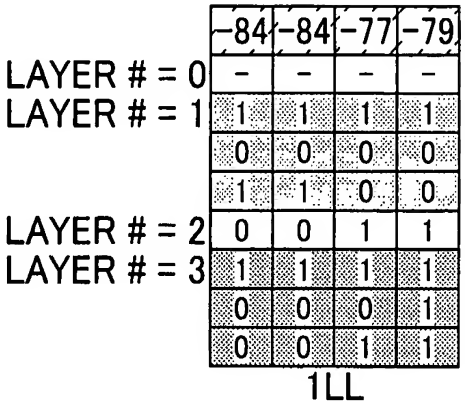


FIG.5C

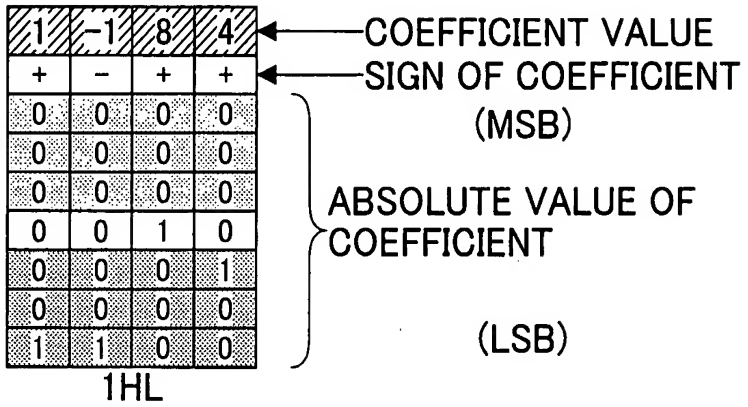


FIG.5D

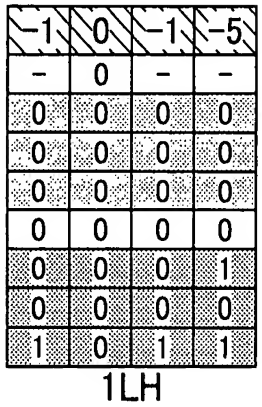


FIG.5E

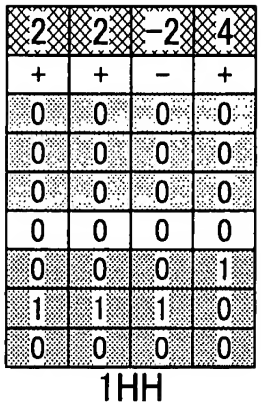


FIG.6

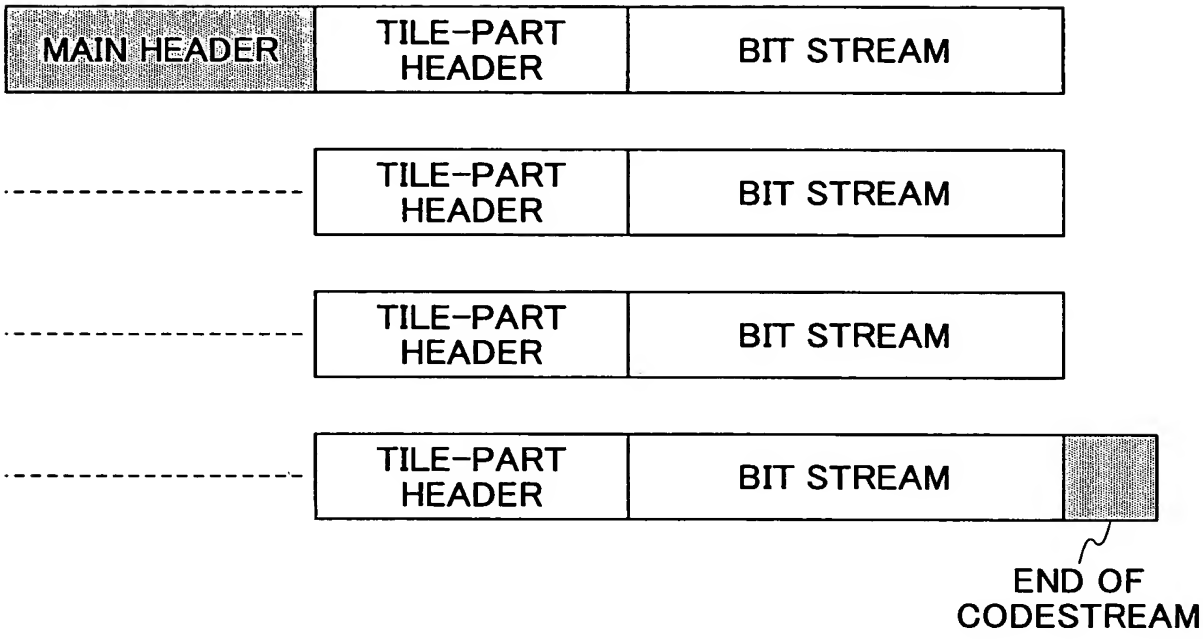

MAIN HEADER
TILE-PART HEADER
BIT STREAM
TILE-PART HEADER
BIT STREAM
TILE-PART HEADER
BIT STREAM
TILE-PART HEADER
BIT STREAM
END OF CODESTREAM

FIG.7

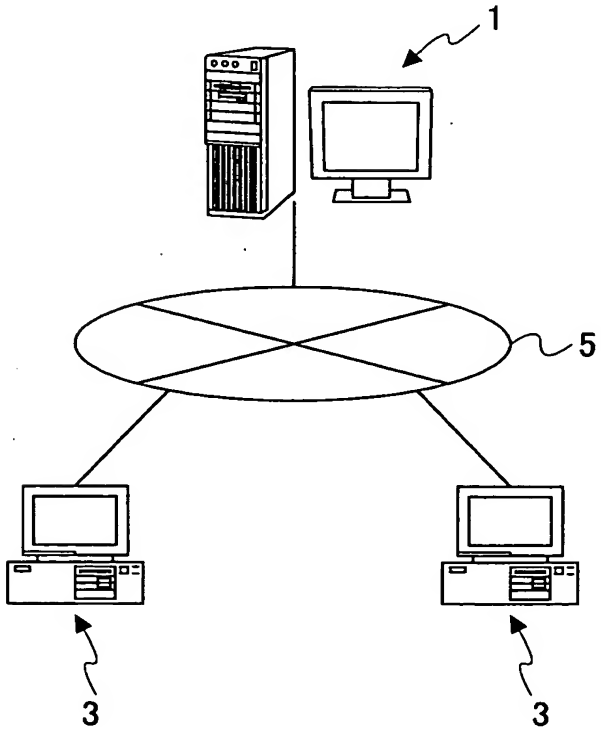

1
5
3
3

FIG.8

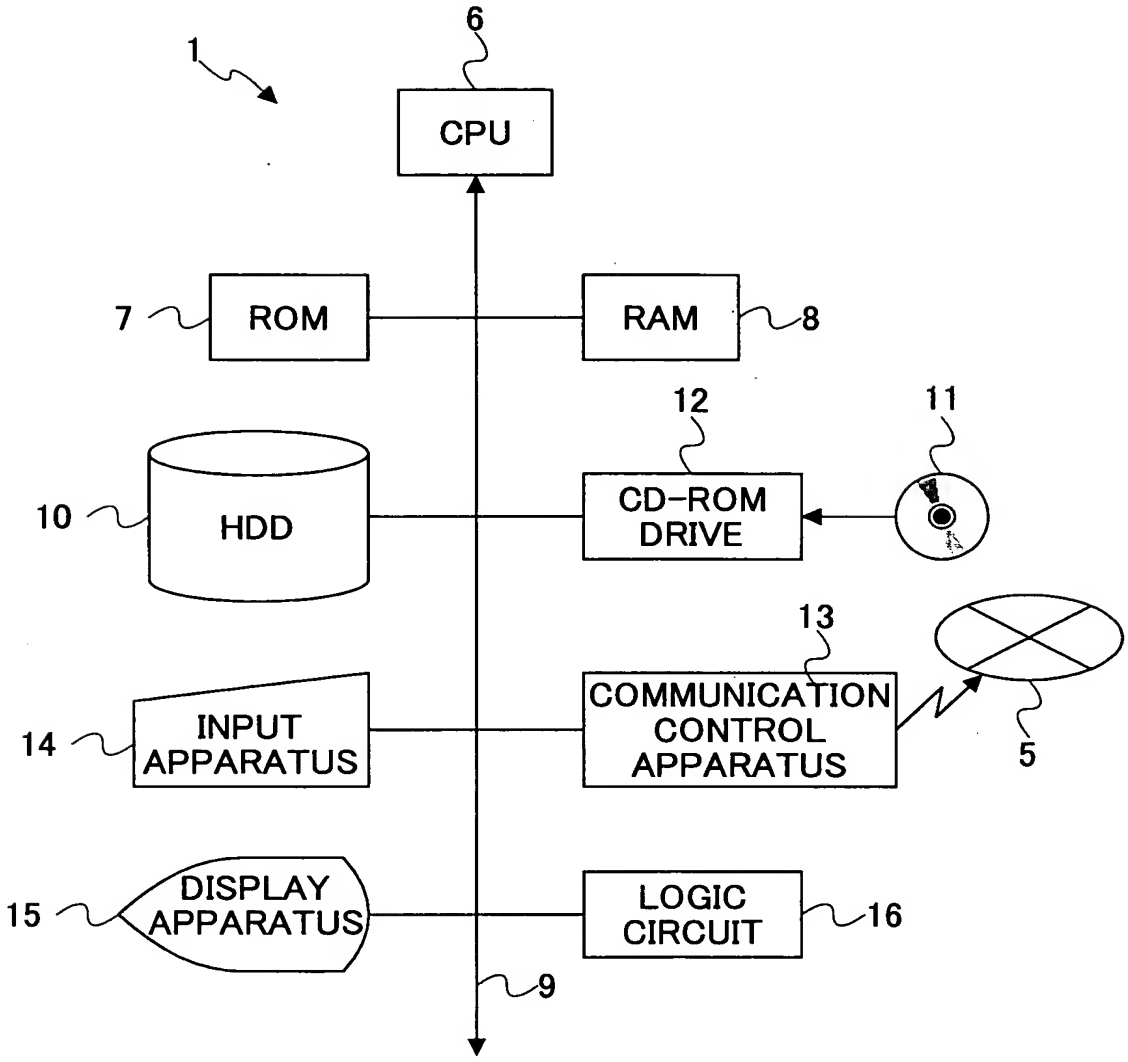

1
6
CPU
7
ROM
RAM
8
12
11
10
HDD
CD-ROM DRIVE
13
COMMUNICATION CONTROL APPARATUS
5
14
INPUT APPARATUS
15
DISPLAY APPARATUS
LOGIC CIRCUIT
16
9

FIG.9A

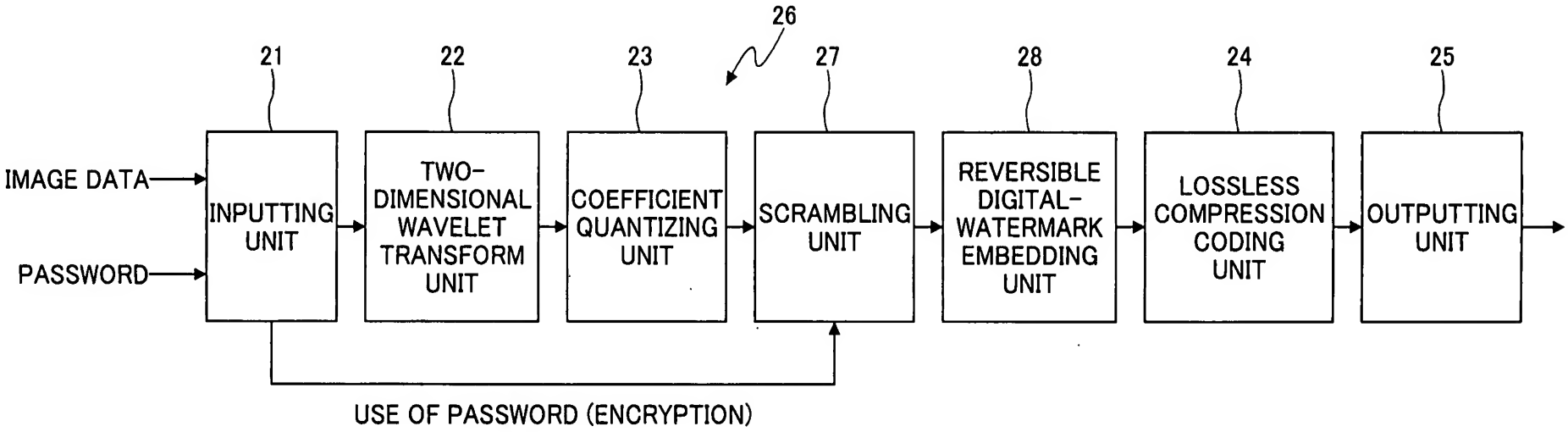

26
21
22
23
27
28
24
25
IMAGE DATA
PASSWORD
INPUTTING UNIT
TWO-DIMENSIONAL WAVELET TRANSFORM UNIT
COEFFICIENT QUANTIZING UNIT
SCRAMBLING UNIT
REVERSIBLE DIGITAL-WATERMARK EMBEDDING UNIT
LOSSLESS COMPRESSION CODING UNIT
OUTPUTTING UNIT
USE OF PASSWORD (ENCRYPTION)

FIG.9B

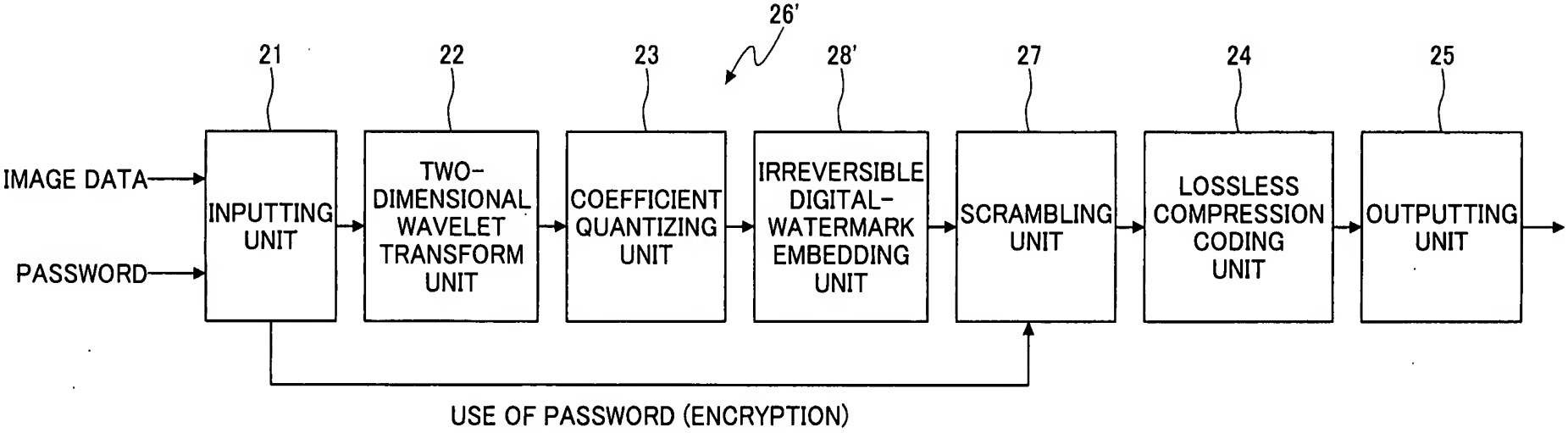
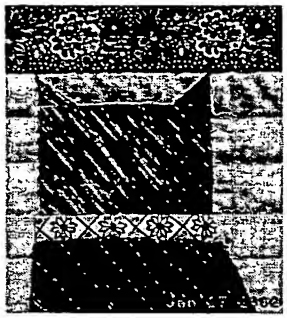

26'
21
22
23
28'
27
24
25
IMAGE DATA
PASSWORD
INPUTTING UNIT
TWO-DIMENSIONAL WAVELET TRANSFORM UNIT
COEFFICIENT QUANTIZING UNIT
IRREVERSIBLE DIGITAL-WATERMARK EMBEDDING UNIT
SCRAMBLING UNIT
LOSSLESS COMPRESSION CODING UNIT
OUTPUTTING UNIT
USE OF PASSWORD (ENCRYPTION)

FIG.10

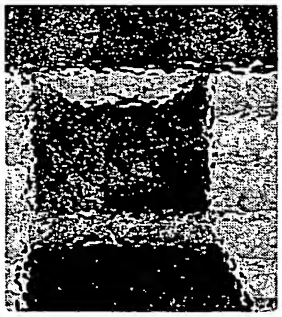
A	k−1	k	k+1	k+2
B	11	19	23	20
C	(+2)*2	(−3)*2	(−1)*2	(+1)*2

FIG.11



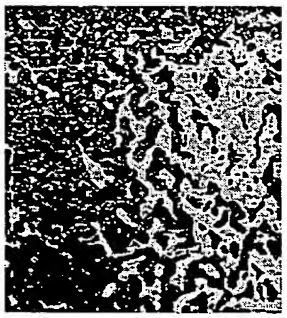
[ORIGINAL IMAGE]

(REVERSIBLE CONVERSION)



[LOW SCRAMBLING]

[MEDIUM SCRAMBLING]



[HIGH SCRAMBLING]

FIG.12

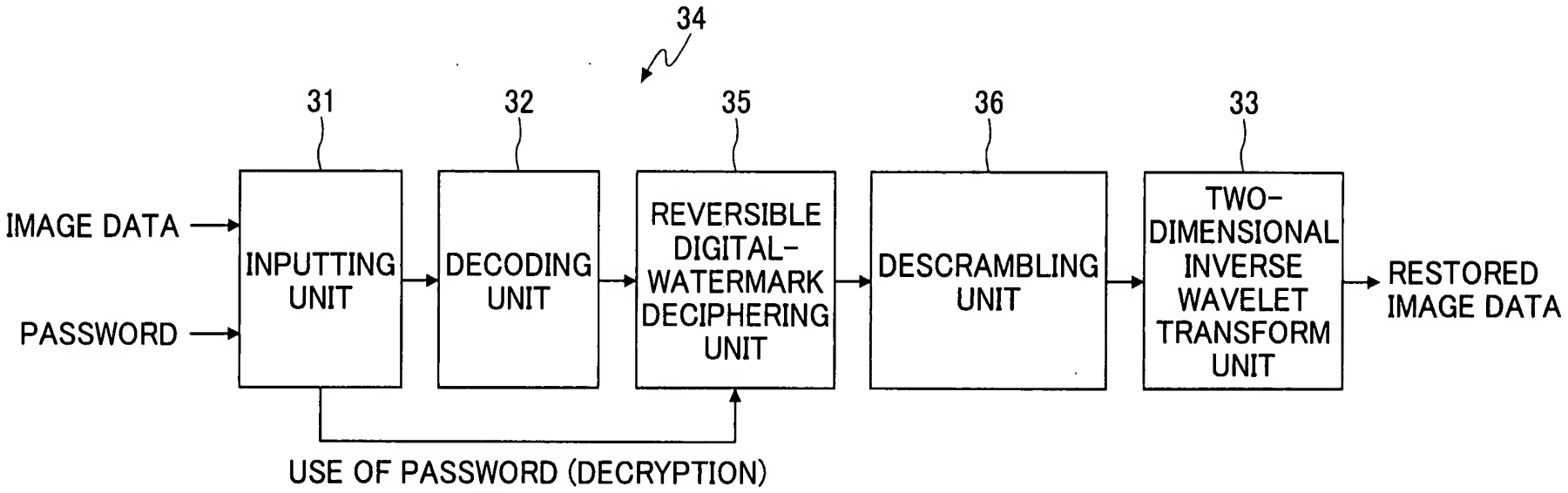

34
31
32
35
36
33
IMAGE DATA
PASSWORD
INPUTTING UNIT
DECODING UNIT
REVERSIBLE DIGITAL-WATERMARK DECIPHERING UNIT
DESCRAMBLING UNIT
TWO-DIMENSIONAL INVERSE WAVELET TRANSFORM UNIT
RESTORED IMAGE DATA
USE OF PASSWORD (DECRYPTION)

FIG.13A

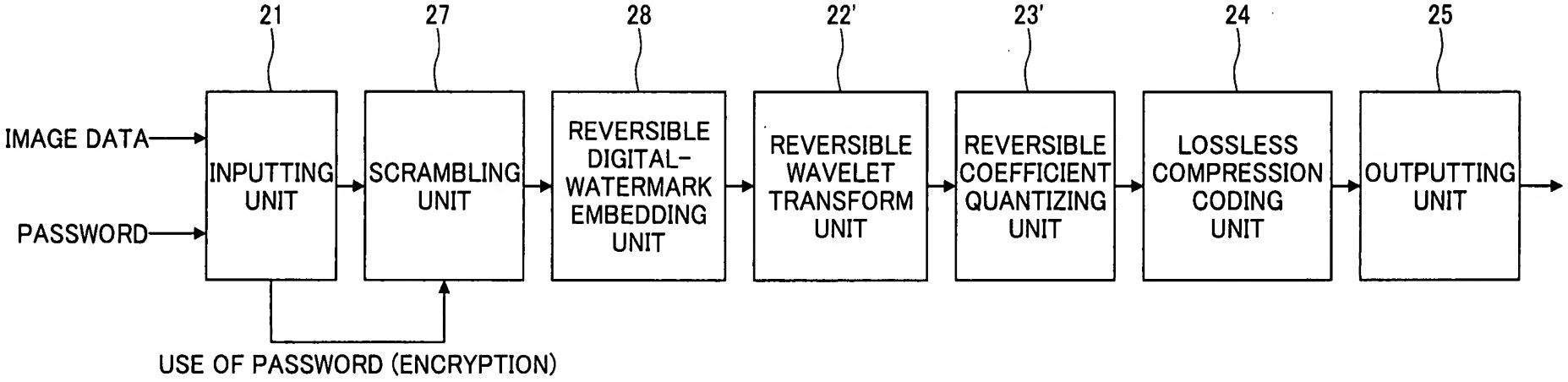
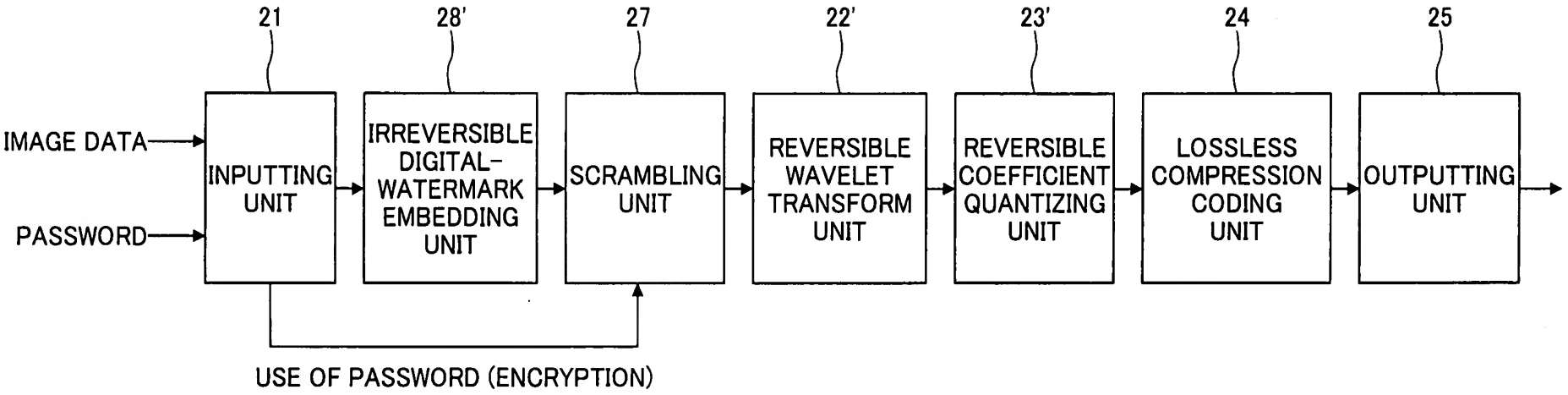



FIG.13B